

## CLAIMS

- 1    1. An optical filter comprising:  
2            at least one ring resonator that is apt to receive as input an optical signal having  
3    a plurality of channels from an input optical source; and  
4            at least one unbalanced Mach-Zehnder module nested in said at least one ring  
5    resonator, wherein said at least one unbalanced Mach-Zehnder module and said at least  
6    one ring resonator are apt to filter at least one selective channel from said optical  
7    signal.
- 1    2. The optical filter of claim 1, wherein said at least one unbalanced Mach-Zehnder  
2    module comprises an absorber.
- 1    3. The optical filter of claim 1, wherein said at least one ring resonator comprises two  
2    or more ring resonators.
- 1    4. The optical filter of claim 3, wherein said at least one unbalanced Mach-Zehnder  
2    module comprises three unbalanced MZI structures.
- 1    5. The optical filter of claim 3, wherein said at least one unbalanced Mach-Zehnder  
2    module comprises two unbalanced MZI structures.
- 1    6. The optical filter of claim 1, wherein said at least one ring resonator comprises a  
2    SiO<sub>2</sub>:Ge waveguide and SiO<sub>2</sub> cladding.
- 1    7. The optical filter of claim 1, wherein said at least one ring resonator comprises a  
2    SiON waveguide and SiO<sub>2</sub> cladding.

- 1 8. The optical filter of claim 1, wherein said at least one ring resonator comprises a  
2  $\text{Si}_3\text{N}_4$  waveguide and  $\text{SiO}_2$  cladding.
- 1 9. The optical filter of claim 1 further comprising a tuning mechanism for tuning the  
2 properties of said optical filter.
- 1 10. The optical filter of claim 9, wherein said tuning mechanism tunes the properties  
2 of the optical filter thermally.
- 1 11. The optical filter of claim 9, wherein said tuning mechanism tunes the properties  
2 of the optical filter using electro-optic effect.
- 1 12. The optical filter of claim 1, wherein said optical filter is implemented in a fiber  
2 optical system.
- 1 13. The optical filter of claim 1, wherein said optical filter is implemented in a Planar  
2 Lightwave Circuit.
- 1 14. The optical filter of claim 1, wherein said at least one unbalanced MZI module is  
2 implemented along one arm of said least one ring resonator.
- 1 15. The optical filter of claim 1, wherein said at least one unbalanced MZI module is  
2 implemented along two arms of said least one ring resonator.
- 1 16. An optical filter comprising:

2 a plurality of filter arrangements including at least one ring resonator that is apt  
3 to receive as input an optical signal having a plurality of channels from an input optical  
4 source; and

5 at least one unbalanced Mach-Zehnder module nested in said at least one ring  
6 resonator, wherein said at least one unbalanced Mach-Zehnder module and said at least  
7 one ring resonator are apt to filter at least one selective channel from said optical  
8 signal.

1 17. The optical filter of claim 16, wherein said at one ring resonator comprises two or  
2 more ring resonators.

1 18. The optical filter of claim 17, wherein said at least one unbalanced Mach-Zehnder  
2 module comprises three unbalanced MZI structures.

1 19. The optical filter of claim 17, wherein said at least one unbalanced Mach-Zehnder  
2 module comprises two unbalanced MZI structures.

1 20. The optical filter of claim 16, wherein said at least one ring resonator comprises a  
2 SiO<sub>2</sub>:Ge waveguide and SiO<sub>2</sub> cladding.

1 21. The optical filter of claim 16, wherein said at least one ring resonator comprises a  
2 SiON waveguide and SiO<sub>2</sub> cladding.

1 22. The optical filter of claim 16, wherein said at least one ring resonator comprises a  
2 Si<sub>3</sub>N<sub>4</sub> waveguide and SiO<sub>2</sub> cladding.

1 23. The optical filter of claim 16 further comprising a tuning mechanism for tuning the  
2 properties of said optical filter.

1 24. The optical filter of claim 23, wherein said tuning mechanism tunes the properties  
2 of the optical filter thermally.

1 25. The optical filter of claim 23, wherein said tuning mechanism tunes the properties  
2 of the optical filter using electro-optic effect.

1 26. The optical filter of claim 16, wherein said optical filter is implemented in a fiber  
2 optical system.

1 27. The optical filter of claim 16, wherein said optical filter is implemented in a Planar  
2 Lightwave Circuit.

1 28. The optical filter of claim 16, wherein said at least one unbalanced MZI module is  
2 implemented along one arm of said least one ring resonator.

1 29. The optical filter of claim 16, wherein said at least one unbalanced MZI module is  
2 implemented along two arms of said least one ring resonator.

1 30. A method of optical filtering, said method comprising:

2 providing at least one ring resonator that receives as input an optical signal  
3 having a plurality of channels from an input optical source; and

4 providing at least one unbalanced Mach-Zehnder module nested in said at least  
5 one ring resonator, wherein said at least one unbalanced Mach-Zehnder module and

6 said at least one ring resonator filtering at least one selective channel from said optical  
7 signal.

1 31. The method of claim 30, wherein said at least one unbalanced Mach-Zehnder  
2 module comprises an absorber.

1 32. The method of claim 30, wherein said at one ring resonator comprises two or more  
2 ring resonators.

1 33. The method of claim 32, wherein said at least one unbalanced Mach-Zehnder  
2 module comprises three unbalanced MZI structures.

1 34. The method of claim 32, wherein said at least one unbalanced Mach-Zehnder  
2 module comprises two unbalanced MZI structures.

1 35. The method of claim 30, wherein said at least one ring resonator comprises a  
2 SiO<sub>2</sub>:Ge waveguide and SiO<sub>2</sub> cladding.

1 36. The method of claim 30, wherein said at least one ring resonator comprises a SiON  
2 waveguide and SiO<sub>2</sub> cladding.

1 37. The method of claim 30, wherein said at least one ring resonator comprises a Si<sub>3</sub>N<sub>4</sub>  
2 waveguide and SiO<sub>2</sub> cladding.

1 38. The method of claim 30 further comprising tuning the properties of said optical  
2 filter.

1 39. The method of claim 38, wherein said tuning the properties of the optical filter is  
2 done thermally.

1 40. The method of claim 38, wherein said tuning the properties of the optical filter is  
2 done using electro-optic effect.

1 41. The method of claim 30, wherein said optical filter is implemented in a fiber  
2 optical system.

1 42. The method of claim 30, wherein said optical filter is implemented in a Planar  
2 Lightwave Circuit.

1 43. The method of claim 30, wherein said at least one unbalanced MZI module is  
2 implemented along one arm of said least one ring resonator.

1 44. The method of claim 30, wherein said at least one unbalanced MZI module is  
2 implemented along two arms of said least one ring resonator.

1 45. A method of optical filtering, said method comprising:  
2 providing a plurality of filter arrangement including at least one ring resonator  
3 that receives as input an optical signal having a plurality of channels from an input  
4 optical source; and

5 providing at least one unbalanced Mach-Zehnder module nested in said at least  
6 one ring resonator, wherein said at least one unbalanced Mach-Zehnder module and  
7 said at least one ring resonator filtering at least one selective channel from said optical  
8 signal.

- 1 46. The method of claim 45, wherein said at one ring resonator comprises two or more  
2 ring resonators.
- 1 47. The method of claim 46, wherein said at least one unbalanced Mach-Zehnder  
2 module comprises three unbalanced MZI structures.
- 1 48. The method of claim 46, wherein said at least one unbalanced Mach-Zehnder  
2 module comprises two unbalanced MZI structures.
- 1 49. The method of claim 45, wherein said at least one ring resonator comprises a  
2 SiO<sub>2</sub>:Ge waveguide and SiO<sub>2</sub> cladding.
- 1 50. The method of claim 45, wherein said at least one ring resonator comprises a SiON  
2 waveguide and SiO<sub>2</sub> cladding.
- 1 51. The method of claim 45, wherein said at least one ring resonator comprises a Si<sub>3</sub>N<sub>4</sub>  
2 waveguide and SiO<sub>2</sub> cladding.
- 1 52. The method of claim 45 further comprising tuning the properties of said optical  
2 filter.
- 1 53. The method of claim 52, wherein said tuning the properties of the optical filter is  
2 done thermally.
- 1 54. The method of claim 52, wherein said tuning the properties of the optical filter is  
2 done using electro-optic effect.

1 55. The method of claim 45, wherein said optical filter is implemented in a fiber  
2 optical system.

1 56. The method of claim 45, wherein said optical filter is implemented in a Planar  
2 Lightwave Circuit.

1 57. The method of claim 45, wherein said at least one unbalanced MZI module is  
2 implemented along one arm of said least one ring resonator.

1 58. The method of claim 45, wherein said at least one unbalanced MZI module is  
2 implemented along two arms of said least one ring resonator.